Bell Ringer - Factoring and Complete the Square

Solve each

y = 2x^2 + 26x + 60

y = 2x^2 + 9x + 7

y = 4x^2 - 100

Complete the square

y = x^2 + 8x + 4

y = 1/2x^2 - 4x - 8

y = 4x^2 + 16x + 36

Solving Quadratic Equations without Factoring

Recall: To solve by factoring,

(1) collect all terms on one side of equal sign
(2) factor the expression
(3) use (a)(b) = 0 to state a = 0 or b = 0

Consider this example:

$$x^2 - 12x + 32 = 0$$

$$(x-8)(x-4) = 0$$

or

$$x - 8 = 0 \qquad x - 4 = 0$$

$$x = 8 \qquad x = 4$$

4.9 (6.4)-Solving Quadratic Equations without Factoring

Vertex form can also be very useful for solving a quadratic equation. find roots

(a) Write $y = x^2 - 12x + 32$ in vertex form

$y = x^2 - 12x + 32$

$= x^2 - 12x + 36 - 36 + 32$

$= (x-6)^2 - 4$

Vertex $(6, -4)$

b) Solve for y = 0

$y = (x-6)^2 - 4$

$0 = (x-6)^2 - 4$

$\sqrt{4} = \sqrt{(x-6)^2}$

$\pm 2 = x - 6$

$6 \pm 2 = x$

OR

$x_1 = 8$ $x_2 = 4$

In some cases, one may be simpler than the other.

Ex.2 Write in factored & vertex form, then choose which to use for solving.

(a) $x^2 + 3x - 4 = 0$

$(x+4)(x-1) = 0$

OR

$x = -4$ $x = 1$

AOS: $\frac{-4+1}{2}$

$x = -1.5$

sub $x = -1.5$ to solve k

$= (-1.5+4)(-1.5-1)$

$= (2.5)(-2.5)$

$= -6.25$

$\therefore$ factored form is $y = (x+4)(x-1)$ &

Vertex form is $y = (x+1.5)^2 - 6.25$

Ex.2 Write in factored & vertex form, then choose which to use for solving.

(b) $x^2 - 9 = 7$

$x^2 - 9 - 7 = 0$

$\boxed{x^2 - 16 = 0}$

$\sqrt{x^2} = \sqrt{16}$

$x = \pm 4$

Vertex Form

$y = x^2 - 16$

Factored Form

$y = (x - 4)(x + 4)$

If factoring is not possible use the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

which is derived from completing the square (p.337-338).

Note: To use the quadratic formula, the equation must be in standard form, $ax^2 + bx + c = 0$.

The '$\pm$' symbol means there are two solutions.

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{or} \quad x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

Ex.3 Solve using the quadratic formula.

a) $x^2 - 4x - 3 = 0$

a b c

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-3)}}{2(1)}$$

$$= \frac{4 \pm \sqrt{28}}{2}$$

$$x_1 = \frac{4 + \sqrt{28}}{2} \doteq 4.65$$

$$x_2 = \frac{4 - \sqrt{28}}{2} \doteq -0.65$$

b) $x^2 - 2x - 5 = 0$

$x_1 \doteq 3.45$

$x_2 \doteq -1.45$

Assigned Work:

p.343 # 1ad, 3, 4bdf, 5ace, 9ad, 10d, 14, 19*